HSALT

Hold Short Advisory Landing Technology System (HSALT)

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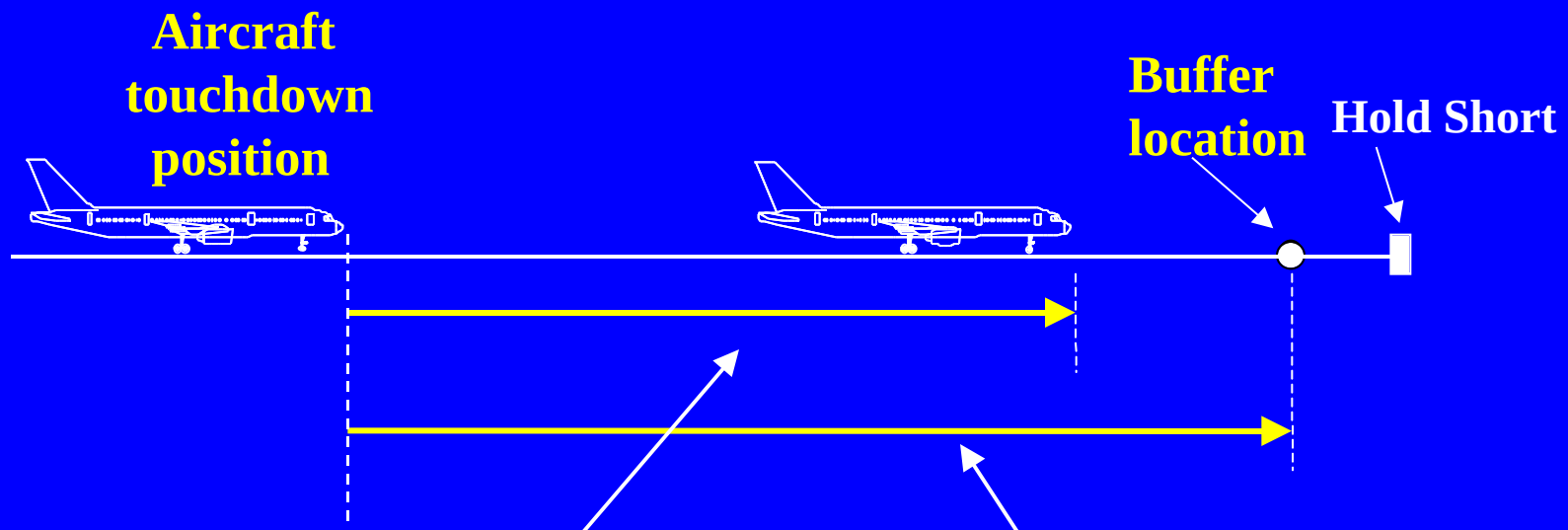
Problem

- **In 1998 *safety considerations* caused FAA to restrict Land and Hold Short Operations (LAHSO) to *dry* runways, *clear* weather, *no tail winds*, and *daytime* ops unless special lighting installed (see Av Wk, 2/15/99)**
- **Safety of LAHSO has been and is still a concern to ALPA**
- **Today, pilots have limited real-time info to mentally judge if operation can be safely performed &, after landing, only have out-the-window info on "how's it going"**
- **With restricted LAHSO, capacity of some airports can be significantly reduced (e.g. O'Hare, Logan)**
- **New systems and procedures needed to safely and efficiently perform Land and Hold Short Operations**

Basic HSALT Information

- **Before Landing**
  - **Provide pilot with info on HUD & ND for judging the difficulty of stopping at hold short location; info provided in Stopping Factor (SF)**
  - **Show pilot runway planview with exits & HS location on ND**
- **After Landing on HUD**
  - **Provide pilot deceleration information/guidance for stopping at hold-short location or decelerating to turnoff speed of earlier exit**
  - **Provide continual situational awareness on criticality of stopping the aircraft at the hold-short**
    - **Instantaneous distance to hold short location**
    - **Instantaneous required deceleration to stop**
    - **Instantaneous aircraft deceleration**

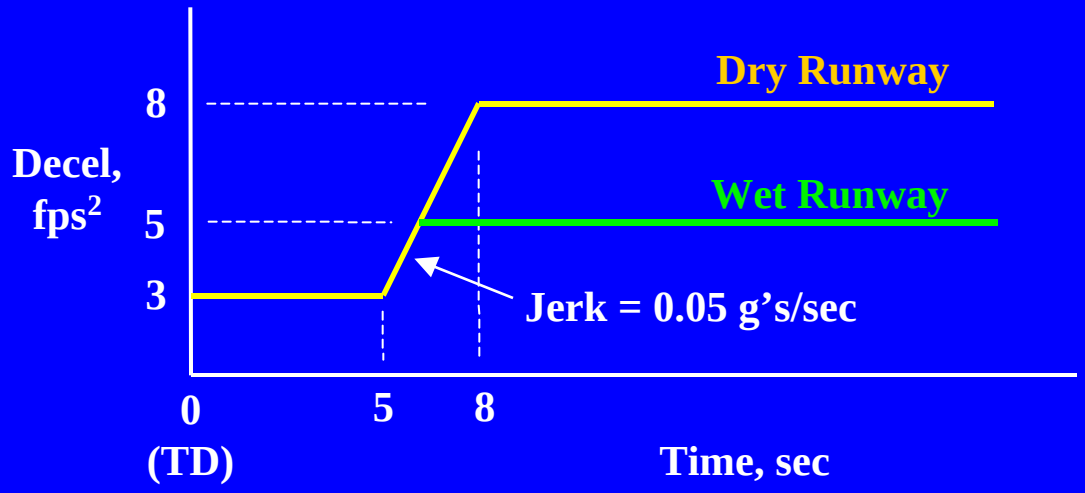
Stopping Factor (SF)



$$SF = \frac{\text{Predicted Distance to Stop}}{\text{Available Distance}}$$

Predicted Stopping Distance

- Assumed deceleration profile



- Assumed TD at 1900 ft beyond threshold
- Assumed coming to stop 200 ft before hold-short location
- Computed predicted landing ground speed
  - Initially FMS Vref + 5 knots &, after on localizer & glideslope, selected CAS
  - Airport temp & airport barometric pressure
  - Runway altitude and winds

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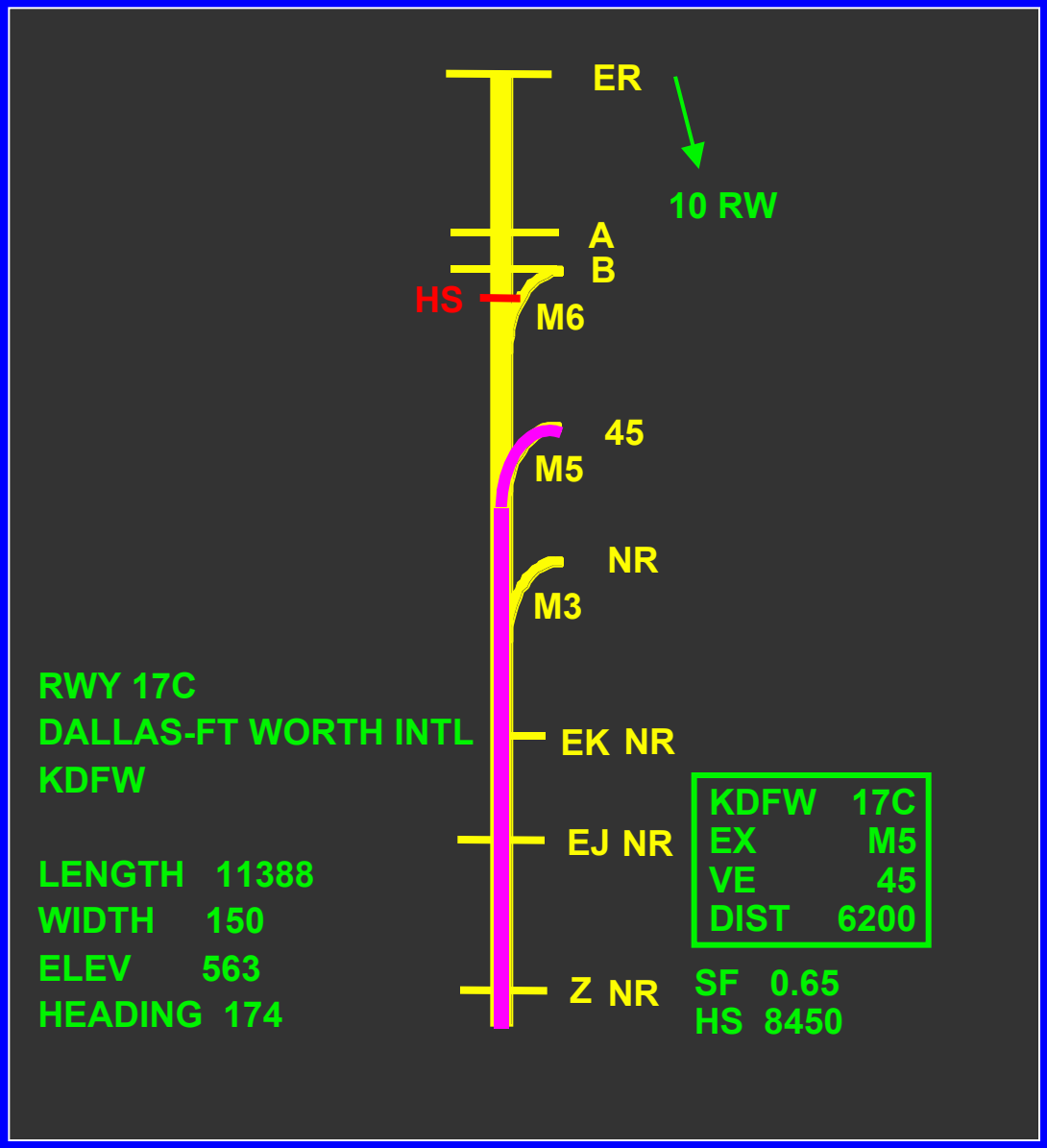
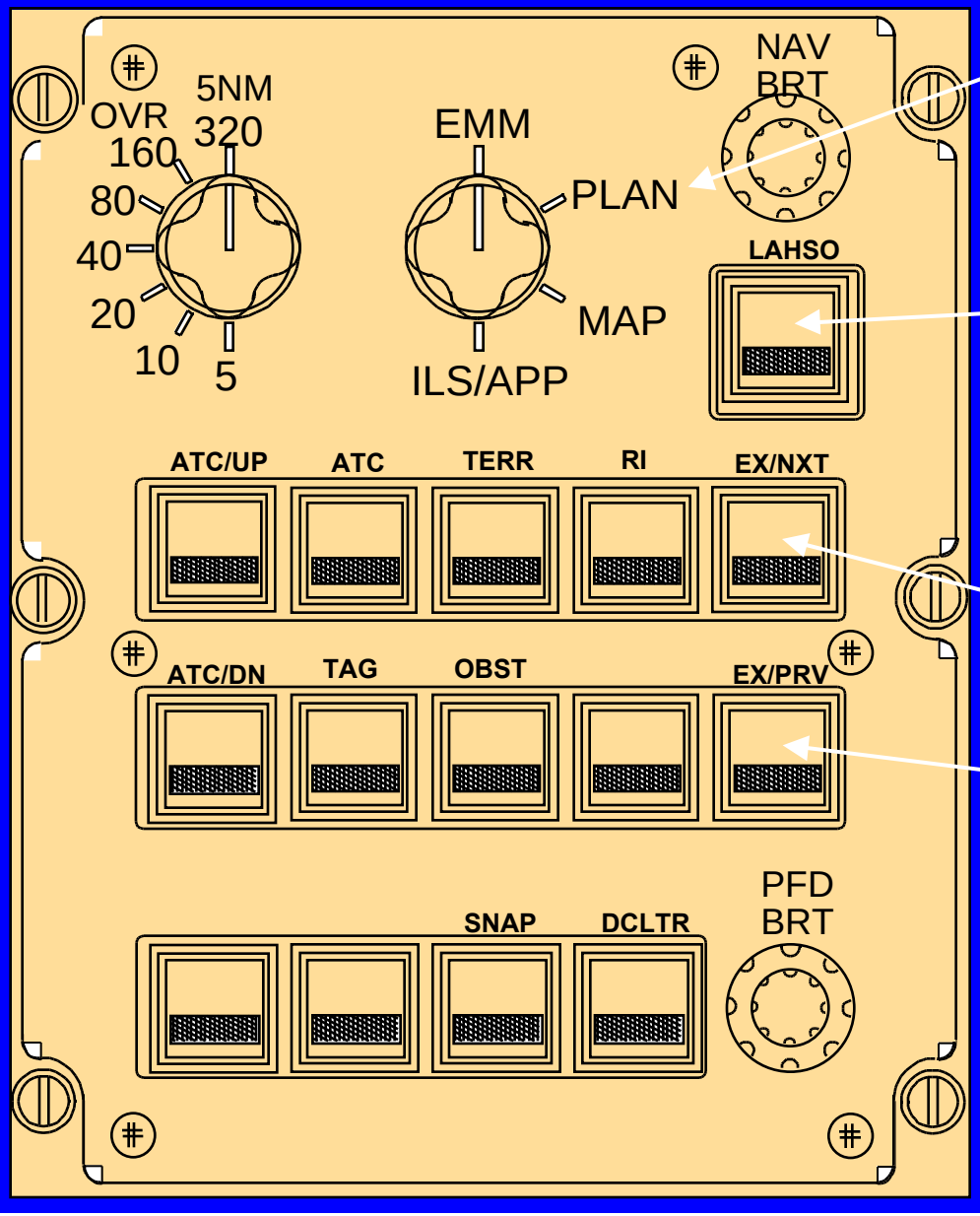
Simulator Cockpit

Runway Planview on ND



Experimental Display Control Panel (EDCP)



Runway Planview

HSALT buttons

Select Land & Hold Short function (runway planview momentarily displayed)

Select next exit

Select previous

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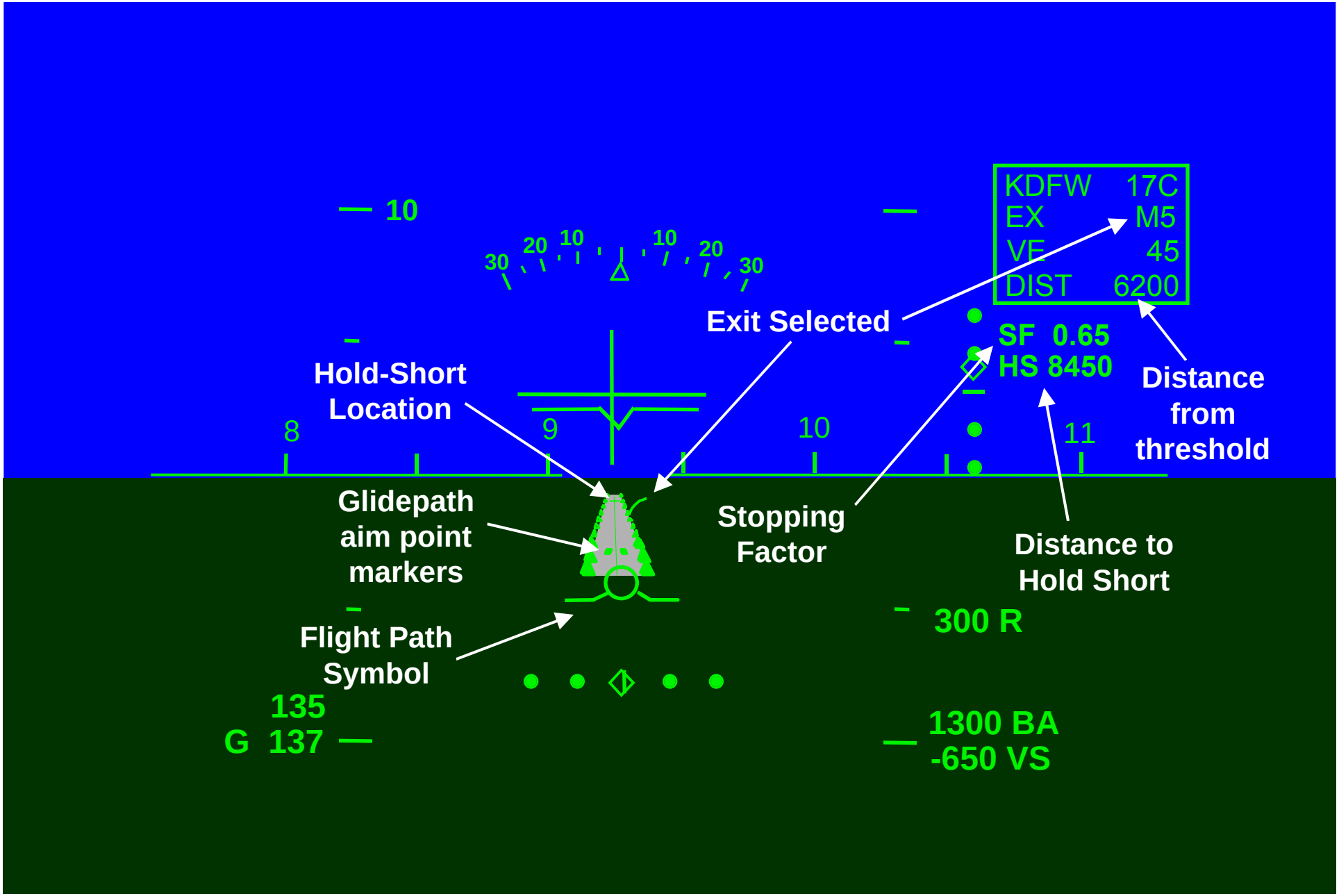
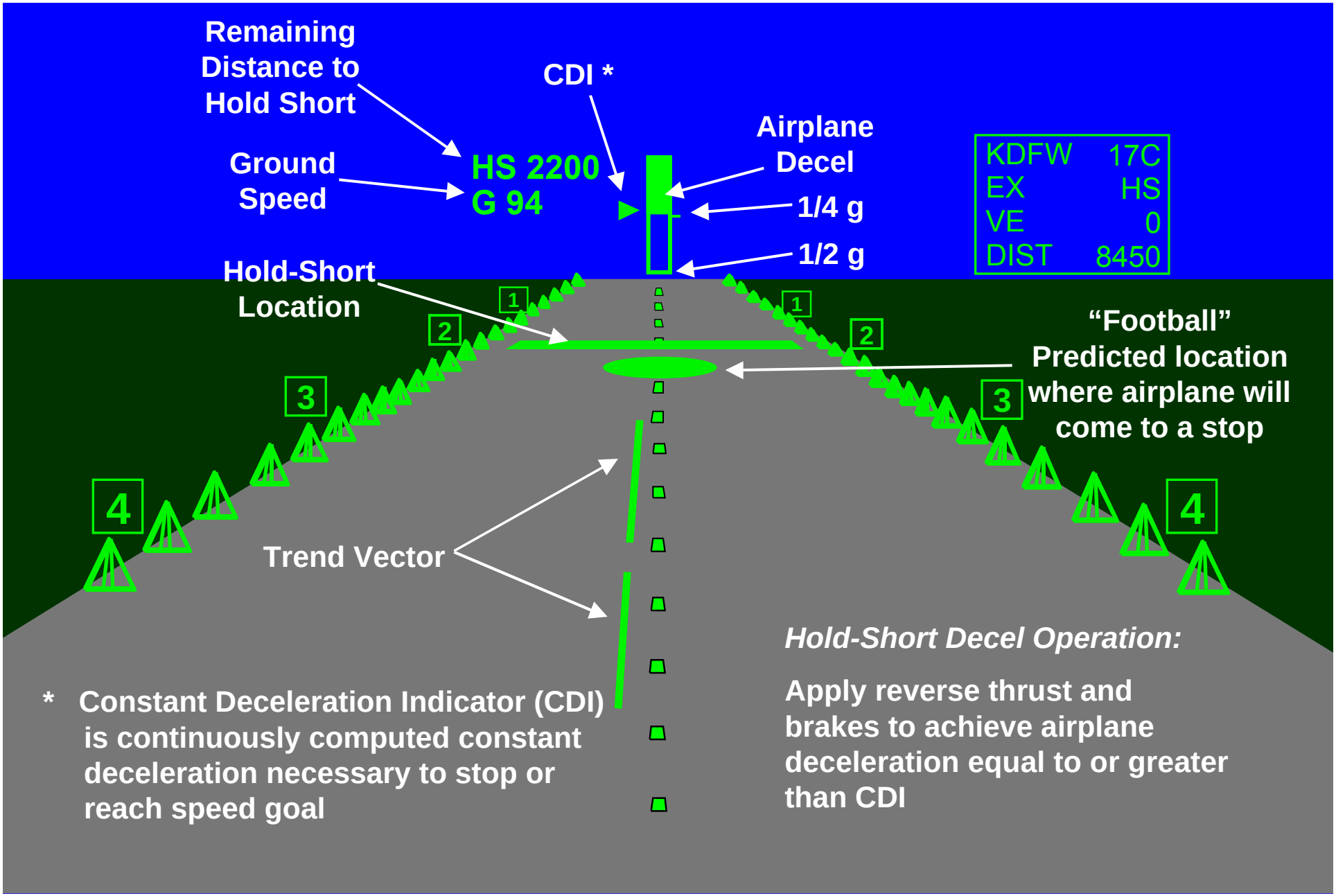
In-Air HUD Symbology



HSALT Decel Guidance to Hold Short



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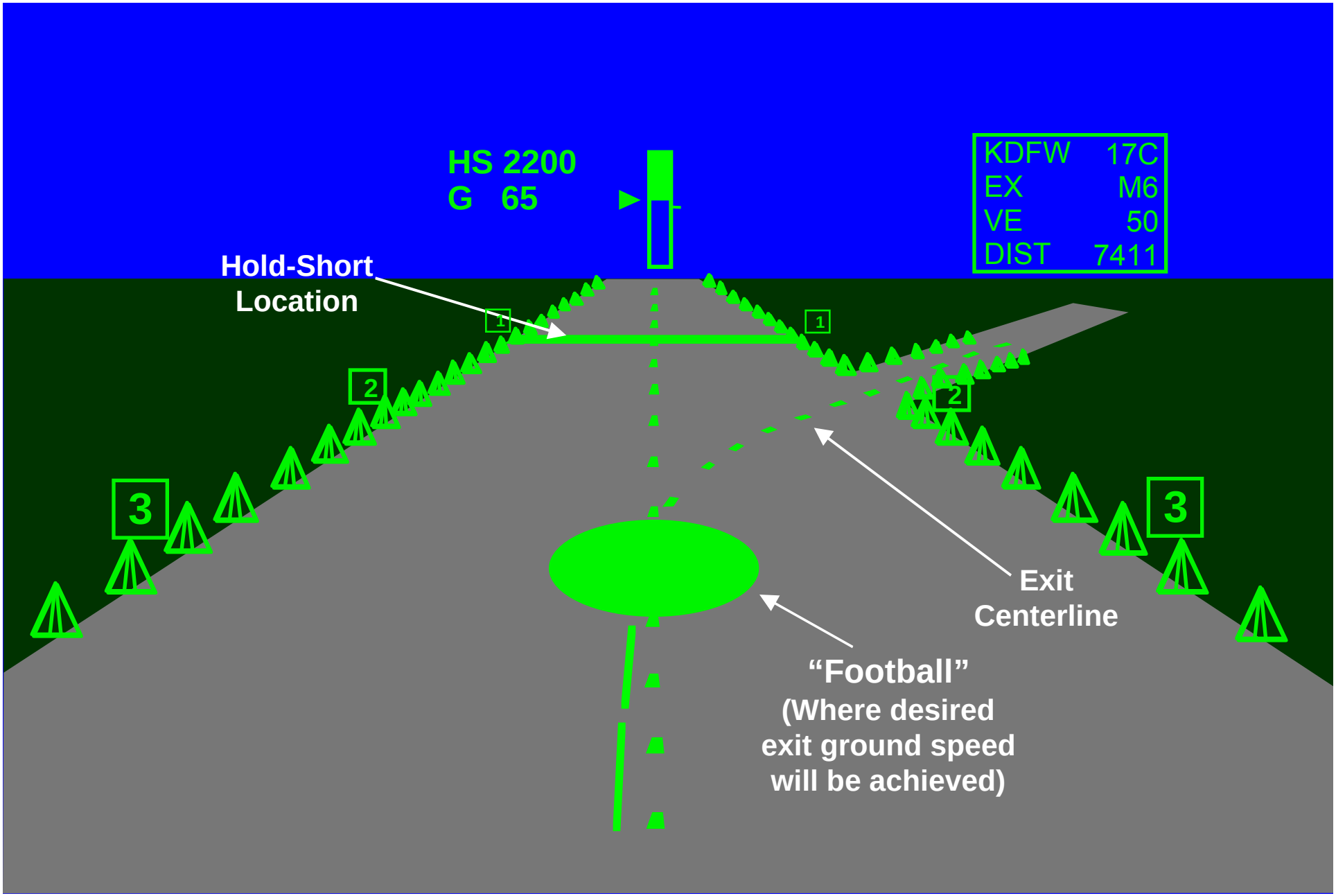
Decel Guidance to Exit



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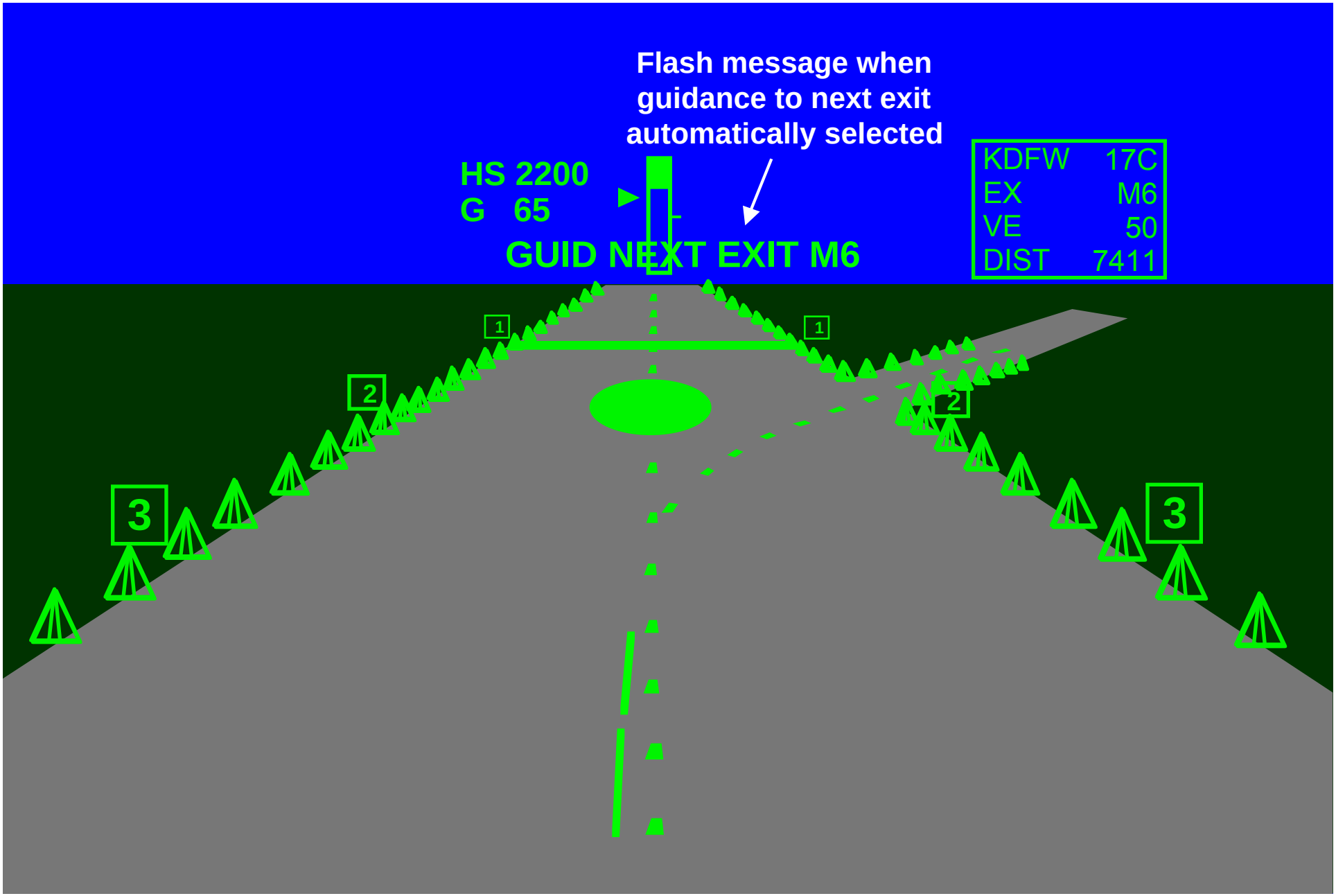
Auto Next-Exit Selection Message



DFW Test Runs

- **Stopping Factor (SF) equal to 1**
  - **Stopping distance equal to available distance**
  - **Evaluate stopping difficulty**
- **Missed Exit Logic (MEL)**
  - **Select guidance to 1st high-speed exit and then intentionally go past all the exits prior to hold-short**
  - **Evaluate HUD message timing and display format for auto exit changes and dynamics changes of HUD symbology**
  - **Stop at hold short location after last available exit**

Some Flight Test Results

- **All of the four (4) subject pilots indicated that there was no problem stopping at the hold-short location with SF = 1**
- **Three pilot questionnaires returned indicating**
  - **Decel guidance very useful & not difficult to use**
  - **Decel bar guidance very useful**
- **Some pilot comments during or post flight**
  - **“Really liked the hold short bar on graphical runway”**
  - **“Looks good! Wouldn’t change a thing”**
  - **“What a tool! What a tool!”**
- **Pilots also expressed that HSALT has application beyond LAHSO**
  - **Rollout & turnoff for reduced runway occupancy time**
  - **Contaminated/wet runway operations**
  - **Rejected takeoff**